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Application of the Mössbauer effect to the study of opto-acoustic phenomena

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Abstract

© 2015 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim. We present the results of the proof of principle experiment on the observation of the acoustic oscillations induced by the pulsed laser excitation. Time domain spectra agree well with the model of the frequency modulation of Mössbauer radiation passing through a vibrating resonance medium. The ratio of the fourth and second Fourier harmonics D4Ω/D2Ω of the modulated radiation is suggested to measure the modulation index since this ratio is very sensitive to the amplitude of nuclear vibrations. The proposed methodology may be used for the study of opto-acoustic phenomena. If the absorber vibrates along the propagation direction of gamma quanta, the Mössbauer absorption line is split into a frequency comb with a period equal to the vibration frequency. If the vibration frequency is much smaller than the absorption linewidth, frequency-domain Mössbauer spectra do not see this frequency comb. Vagizov et al. show that time-domain Mössbauer spectra are capable to resolve the vibration frequency, which helps to study opto-acoustical phenomena.

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Keywords

Frequency modulation, Mössbauer effect, Opto-acoustic phenomena